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III. OTHER PROVISIONS

Nuclear Safety Council

13982 *Instruction IS-22, revision 1, of the 15th November 2017, of the Nuclear Safety Council regarding safety requirements for the management of the ageing and long-term operation of nuclear power plants.*

Article 2.a) of Law 15/1980, of the 22nd April, of the creation of the Nuclear Safety Council, attributes to this Public Entity the authority to "develop and approve the Instructions, Memoranda and Guides of a technical nature relating to nuclear and radioactive facilities and activities related to nuclear safety and radiological protection" that guarantee the safe functioning, that is, free from undue risks to persons or the environment, of nuclear and radioactive facilities.

The Nuclear Safety Council, within the Limits and conditions of the authorisations of use of nuclear plants, singularly requires that the owners of said installations implement a process of management of the ageing of the structures, systems and components of nuclear plants during their design lifetime, extending, if applicable, to their long-term operation period.

To this effect, in 2004 the Nuclear Safety Council developed the document named Conditions for the long-term operation of nuclear plants, which contains the basic criteria applicable to the applications for long-term operation, and the legal and administrative framework for the renewal of the Authorisations of Use for long-term operation of nuclear plants.

Subsequently, safeguarded by that established in article 8.3 of the Regulation on Nuclear and Radioactive Facilities (Royal Decree 1836/1999, of the 3rd December) and complying with the necessity of incorporating these requirements into the Spanish juridical framework, on the 1st July 2009 the Nuclear Safety Council approved the instruction IS-22 "Safety requirements for the management of ageing and long-term operation of nuclear power plants" (OSG of the 10th July 2009).

This revision of the Instruction IS-22 complies with the necessity of updating and clarifying the requirements of the Nuclear Safety Council for the development of a process of management of the ageing of the structures, systems and components of nuclear plants, including the eventuality of a long-term operation period. This is based on the experience derived from said instruction's application from 2009 onwards by the various plants that have highlighted aspects requiring improvement that need to be covered by regulations.

The regulatory requirements (reference levels) agreed upon by the Western European Nuclear Regulators Association (WENRA) have been taken into account in this Instruction, with the object of harmonising the regulations of the various countries.

The methodology accepted by the NSC for compliance with this Instruction is developed in the corresponding safety guide.

The ageing management activities defined in this instruction will be based on, at a minimum, the American regulations contained in regulation 10 CFR 54 "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" and in the documents that develop said regulation, both by the American regulatory agenda and by the nuclear industry, respectively named "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (NUREG-1800), "Generic Aging Lessons Learned" (NUREG-1801) and Guide number 95-10 of the United States Nuclear Regulatory Commission.

In accordance with all the above-mentioned, and in compliance with the legal authorisation laid out in article 2.a) of Law 15/1980, of the 22nd April, of the creation of the Nuclear Safety Council

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and previous consultation of the affected sectors, and following the appropriate technical reports, this Council has agreed upon the following revision 1 of the text of Instruction IS-22 at its meeting of the 15th November 2017, in accordance with the following:

One. *Subject and scope of application.*

This Instruction aims to establish the requirements for the management of the ageing of the structures, systems and components important for the safety of nuclear plants (in accordance with the scope established in the third article) during their design lifetime period and period of long-term operation.

The requirements established in this Instruction are applicable to all the operating conditions of a nuclear plant.

Two. *Definitions.*

The definitions of the terms and concepts contained in this Instruction correspond to those contained in the following standards:

Law 25/1964, of the 29th April, on Nuclear Energy.

Law 15/1980, of the 22nd April, on the creation of the Nuclear Safety Council.

Royal Decree 1836/1999, of the 3rd September, approving the Regulation on Nuclear and Radioactive Facilities.

Furthermore, within the context of this Instruction, the following definitions are applicable:

"Time-Limited Ageing Analyses" (TLAAs): Analyses and calculations carried out by the owner of the facility that comply with the following conditions:

1. Are related to the structures, systems and components (SSCs) considered within the scope of the ageing management.
2. Consider the effects of ageing over time.
3. Maintain limited design lifetime hypotheses.
4. Conclude with the capacity, or not, of the SSCs to continue functioning, in accordance with their defined functions, after having surpassed the limited design lifetime hypotheses.
5. The calculation or analysis was considered relevant by the owner in a safety evaluation.
6. The calculation or analysis forms part of the current licensing bases of the facility.

"Safety Analyses": Technical studies that allow demonstration of compliance with the safety requirements to which the facility is subject. The safety analyses are carried out utilising basic assumptions relative to the operating conditions of the facility. The validity of a safety analysis is limited by the compilation of the basic assumptions utilised.

"Licensing bases": These are the compilation of requirements with obligatory compliance, regulatory commitments and exemptions derived both from the regulations applied at the start of the plant lifespan and from the regulations subsequently incorporated.

The Licensing bases are listed in the official documents of plant use, in terms of the conditions associated with their approval and in the Authorisation of Use, as well as in the commitments of the owner to ensure compliance with the design bases of the system that are important for safety (including modifications carried out).

"Passive components": Are those components and structures that perform their function without the participation of mobile parts or changes in their configuration or properties.

"Long-life components": Are those components and structures that are not subject to substitution based on a qualified lifespan or a specified time period.

"Ageing": General process by which the characteristics of a structure, system or component (SSC) change with time or with use. Ageing

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manifests itself in the progressive degradation (continuous or discontinuous) of materials and that of the capacity of the SSCs to perform their functions over time.

"Structures, systems and components" (SSCs): General term that covers all the elements of a facility. Structures are passive elements: buildings, vessels, shields, etc. A system is composed of various components or structures assembled in such a way that they perform a specific function. A component is a specific element of a system. Cables, transistors, integrated circuits, motors, relays, solenoids, pipes, attachments, pumps, tanks and valves, among others, are examples of components.

"Ageing management studies": Analyses that demonstrate that the effects of ageing over time are adequately considered, in the case of the SSCs considered within the scope of ageing management, so that these maintain the functions defined in their licensing bases throughout their useful (or service) lifetime.

"Inherent function": Referring to a SSC, the function due to which the SSC complies with any of the criteria defined within the scope of this Instruction.

"Significant ageing mechanism": A mechanism that, considering its potential development, requires the existence of a control or mitigation activity to guarantee the function of the affected SSCs, during their useful (or service) lifetime.

"Long-term operation": Continued operation of a facility, maintaining an acceptable level of safety, beyond the original design lifetime of the facility, after having undergone a safety evaluation that assures that the safety requirements applicable to the SSC itself are being complied with.

In the case of nuclear plants of Western design (basically North American plants and some European plants), part of the analyses that form the basis of the safety evaluation of the plant are carried out based on a design lifetime hypothesis of 40 years, for example of those components that cannot be replaced, such as the reactor vessel and the containment building.

Due to this, these analyses may be insufficient a priori for the safety evaluation beyond 40 years of operation, a review of the acceptability of said analyses being required for longer lifespan hypotheses.

"Lifetime Management Plan" (LMP): Programme of ageing management actions that aims to attain the original design lifetime of the facility without the deterioration of safety, and maintaining compliance with the licensing bases in force. Development of the LMP is comprised of a compilation of ageing management analyses that cover the following stages: scope and selection of SSCs, review of ageing management and definition and implementation of ageing management programmes (AMPs).

During the period of long-term operation this plan will be known as LT-LMP.

"Integrated Ageing Assessment and Management Plan" (IAAMP): Basic document required for the evaluation of the long-term operation of the plant, and that is comprised of the activities of the Lifetime Management Plan (LMP) and, in addition, the Time-Limited Ageing Analyses (TLAAs) that are necessary for the review of the analyses carried out with a defined design lifetime hypothesis.

"Ageing Management Programmes" (AMPs): Structured compilation of activities directed at monitoring, control and mitigation of the effects and mechanisms of ageing that affect the SSCs that require ageing management. These programmes are based on various predictive and preventative maintenance practices, environmental qualification programmes, periodic testing and monitoring included in the Plant Technical Specifications (PTSs), operational inspection programmes, erosion-corrosion programmes, etc., as well as any other type of specific activity with the same objective that could be carried out within the plant.

"Ageing Management Review" (AMR): Compilation of the activities to be carried out in order to identify the significant effects and mechanisms of ageing that

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affect the SSCs included in the scope of the Lifetime Management Plan (LMP) and for the subsequent assignation of the Ageing Management Programmes (AMPs) necessary for the correct management of said mechanisms.

"Design lifetime": Relating to a SSC, this refers to the time of functionality estimated or calculated in the design, during which the SSC is expected to comply with its function as established in the terms of the licensing bases.

In the case of Spanish nuclear plants, the analyses that form the basis of the plant safety evaluation were carried out based on a design lifetime hypothesis of 40 years, in accordance with the practice of the country of origin of the design.

"Remaining lifetime": Relating to a SSC, the period of time between the current moment and the end of useful (or service) lifetime.

"Useful (or "service") lifetime": Relating to a SSC, the period of time from the start of its operation to its withdrawal from service. Useful lifetime may be greater than the original design lifetime, for example when the actual operating conditions have been less severe than those supposed in the design.

Three. *Scope of ageing management.*

The ageing management activities must include the following SSCs that are important for safety:

3.1 The elements related to safety that must continue functioning during and after any design-based eventuality that could occur, in order to guarantee the following functions:

- The integrity of the reactor coolant pressure barrier,
- The capacity to stop the reactor and maintain it in a safe paused condition, or
- The capacity to prevent or mitigate the consequences of accidents, in such a way that exposure to radioactive substances outside the site remains below the established limits.

3.2 The elements unrelated to safety whose failure could impede satisfactory compliance with any of the functions identified in the above-mentioned article 3.1.

3.3 The elements credited in the safety analyses of the facility, in order to comply with the requirements of anti-fire protection, environmental qualification, pressurised thermal shock, expected transitions without automatic reactor shut-down and total loss of the alternating electric current.

Four. *Criteria for ageing management of nuclear plant SSCs during the design lifetime period.*

4.1 General aspects.

During the design lifetime period, the owner of the facility must carry out the activities necessary for the ageing management of the SSCs of said plant, in such a way that these result in the monitoring, control and mitigation of the significant mechanisms and effects of ageing of the elements identified in the third article of this instruction.

The activities and conclusions related to ageing management, as well as the necessary organisational aspects, are incorporated in a Lifetime Management Plan (LMP) that the owner must revise periodically, at a maximum every 4 years, according to changes in regulations, physical modifications of the design of the plant, results of the review of operative experience and industrial investigation programmes related to ageing management.

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4.2 Requirements.

The compulsory requirements for the development of the LMP must be:

a) Subject to the following scope and selection criteria: The LMP will be applied to those SSCs specified in the third article of this Instruction that comply with the following criteria:

a.1) That are passive: These include, non-exhaustively, the following: the reactor vessel, the reactor coolant pressure barrier, steam generators, the pressuriser, pipes, pump casings, valve bodies, the nucleus cask, component brackets, pressure retention barriers, heat exchangers, ventilator casings, ventilation ducts, the containment, metallic containment cladding, electrical and mechanical penetrations, equipment and staff airlocks, Category 1 seismic structures, electrical cables and connections, cable trays and electrical boxes.

- The following are non-exhaustively excluded: Pumps (except casing), valves (except the body), motors, diesel generators, air compressors, shock absorbers, the control bar propulsion, ventilation valves, pressure transmitters, pressure indicators, level indicators, switchboards, ventilators (except the surrounding), batteries, interrupters, relays, power inverters, electronic cards, battery chargers and electrical power supplies.

a. 2) That are long-life, not included in any substitution programme based on the maintenance of the qualified lifetime, or any other substitution programme.

b) Ageing Management Review:

b. 1) Identification of ageing mechanisms:

The owner must analyse the potential ageing mechanisms, and the possible causes and effects of these, for each structure and component resulting from the application of the process defined in the previous point.

As a consequence of the above-mentioned analyses, the owner will determine those effects and mechanisms considered significant and that require the existence of monitoring, control or mitigation activities to ensure compliance with the inherent function or functions of the structure or component, during its service lifetime.

In particular, the ageing management of the reactor pressure vessel and its soldering will take into account all the relevant factors, at least including fragilisation, thermal ageing and fatigue, to compare its behaviour with the predictions of the analyses over the course of the lifespan of the component.

b.2) Evaluation of maintenance practices:

The objective of this activity will be to evaluate whether the existing maintenance practices within the plant, based on the understanding that these not only include the activities pertaining to predictive and preventative maintenance, but also inspection, testing, operational parameter control, etc. activities, that allow the detection, control and mitigation of the significant ageing effects and mechanisms considered.

These maintenance, inspection and testing practices required in the current licensing bases will be valid for the ageing management of the structures and components affected by the ageing effects and mechanisms considered in said bases.

The evaluation of maintenance practices will consist of a comparison between the monitoring, mitigation and control activities appropriate for each ageing effect and mechanism (significant within each structure or component) and the actual content of the existing maintenance practices that are carried out in said structure or component within the plant.

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a) Definition of ageing management programmes:

The result of the maintenance practices' evaluation will determine the suggestions for improvement necessary for said practices, in order to establish appropriate ageing management and, if applicable, the implementation of new practices, and will result in the launch of ageing management programmes (AMPs).

The owner must have at their disposal a formal procedure of identification and implementation of suggestions for improvement (SI), such as new inspection, testing, monitoring and maintenance activities, incorporated within this period in order to control the effects of new ageing mechanisms identified, if applicable, or in order to optimise the management of those already in existence.

b) Monitoring of ageing management programmes:

The owner must carry out monitoring of the results of the implementation of the AMPs, in order to evaluate their effectiveness and, if applicable, apply the improvements derived from said monitoring.

Five. *Criteria for ageing management of nuclear plant SSCs during their long-term operation period.*

5.1 Requirements of the first authorisation of long-term use.

The first request for renewal of the Authorisation of Use of nuclear plants for a period that surpasses their design lifetime should include, non-exclusively, an Integrated Ageing Assessment and Management Plan (IAAMP), constituted by a series of ageing management studies that reasonably allow the functionality of the elements important for safety contemplated in the third article of this Instruction, considering the new operation period, without prejudice to the provisions in articles 6.2.2 and 6.2.3.

a) Requirements of the IAAMP:

The requirements that the IAAMP should meet must be those established for the LMP in the fourth article of this Instruction. In addition, all the calculations and analyses carried out by the owner of the facility, that comply with the definition of TLAAs included in the second article in this Instruction, should be identified and evaluated for the new requested period.

b) Evaluation methods of the TLAA analyses: The owner of the plant must complete the evaluation of said TLAA analyses through any of the following methods:

1. The verification of the current analyses and calculations are still valid for the new solicited period of operation and, therefore, it is not necessary to conduct a new analysis.
2. The re-evaluation of the current analyses and calculations for the new solicited period of operation and verification that the established approval criteria are met.
3. The demonstration that the effects of ageing can be managed in an adequate manner during the new solicited period of operation through an ageing management programme.

5.2 Ageing management activities during long-term operation.

During the period of long-term operation, the owner of the plant must complete the necessary ageing management activities of the SSCs of the plant through the corresponding ageing management programmes identified in the IAAMP,

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so that the monitoring, control and mitigation of the mechanisms and effects of ageing are ensured, both those identified in said document and those that could newly emerge during said period of long-term operation, for the SSCs important for safety defined in the third article of this Instruction.

All the activities indicated in the previous paragraph are incorporated in the long-term Lifetime Management Plan (LT-LMP) that will be revised periodically, similarly to that established in article 4.1 for the LMP.

5.3 Requirements of subsequent authorisations for long-term use.

The subsequent requests for renewal of the authorisation of use of the plant, within the period of long-term operation, will require the updated presentation of the IAAMP and, additionally, a re-evaluation of the TLAAs already defined, through one of the methods contemplated in article 5.1.b, in which the new solicited period is taken into account, and the identification and evaluation of the new TLAAs, these considered if applicable.

Six. *Ageing management reports and documentation.*

The owners of the nuclear plants will produce ageing management reports that compile the activities carried out in compliance with the fourth and fifth articles of this Instruction. Said reports should be submitted to the Nuclear Safety Council with the content and within the time periods indicated in the following:

6.1 Ageing management reports, within the estimated design lifetime period of the facility:

a) A report will be submitted in the first half of each calendar year that contains the activities of the Lifetime Management Plan (LMP) of the facility carried out in the previous year, concerning monitoring, control and mitigation of the ageing mechanisms of the SSCs, within the scope of ageing management defined in this Instruction, as well as the result of the same application of said activities, the evaluation of their efficiency, the state of the implementation of the proposals for improvement and the identification of the planned revisions of the LMP, according to article 4.1 of this instruction.

b) The ageing management programmes affected by the LMP review, according to article 4.1, will be submitted within one month after their issue.

c) Within the documentation relating to the Periodic Safety Reviews (PSRs) of nuclear power plants, an analysis will be submitted of the activities carried out concerning ageing management within the ten-year period considered by the PSR, in accordance with the Safety Guide 1.10 “Periodic reviews of the safety of nuclear power plants”.

6.2 Ageing management reports for the long-term operation period request:

6.2.1 The request for the renewal of authorisation for use of a period that surpasses the design lifetime of the plant will include an Integrated Ageing Assessment and Management Plan (IAAMP), carried out in accordance with that indicated in article 5.1 of this Instruction. Therefore, a supplement to the Safety Study of the plant will be submitted, in which the studies and analyses that justify the ageing management of the SSCs of the plant in the long-term operation period will be included, and a proposed preliminary revision of the Plant Technical Specifications (PTSs), in which will be included the changes necessary to maintain safe operating conditions within said period.

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6.2.2 The owner must present the documentation relating to the IAAMP three (3) years before the expiration date of the Permit or Authorisation of Use in force, and, subsequently, should present an update of the same document a year before said date, without prejudice to that laid out in article 6.2.3.

6.2.3 For those cases in which the difference between the expiration date of the Authorisation of Use in force and the start date of the period of Long-Term Operation is substantial, the owner will present the IAAMP in accordance with that described in the previous articles. In this case, the documentation corresponding to the results of the evaluation of the Ageing analyses over the time identified can be presented three (3) years before the start of the Long-Term Operation period, without this conditioning the concession term of the Authorisation mentioned.

6.3 Ageing management reports, within the estimated design lifetime period of the facility:

a) The owner will submit, in the first half of each calendar year, a report that contains the activities of the long-term Lifetime Management Plan (LT-LMP) of the facility carried out in the previous year concerning monitoring, control and mitigation of the mechanisms and effects of ageing identified in the IAAMP, and those that could newly emerge, as well as the results of said activities, the evaluation of their efficiency, the state of the implementation of the proposals for improvement and the identification of the planned revisions of the LT-LMP, according to article 5.2 of this instruction.

b) The ageing management programmes affected by the LMP review, according to article 5.2, will be submitted within one month after their issue.

c) Within the documentation relating to the Periodic Safety Reviews (PSRs) of nuclear power plants, an analysis will be submitted of the activities carried out concerning ageing management within the ten-year period considered by the PSR, in accordance with the Safety Guide 1.10 “Periodic reviews of the safety of nuclear power plants”.

6.4 Documentation related to the request for the extension of the long-term operation period.

The owner must present the documentation related to the reviews or future updates of the IAAMP as a consequence of new renewals of the Authorisation of Use within the Long-Term Operation period, within the time periods that the Nuclear Safety Council establishes in this respect, within the limits and conditions associated with the Authorisation of Use in force.

Seven. *Infringements and Penalties.*

This Instruction of the Nuclear Safety Council is bound by that established in article 2.a) of Law 15/1980, of the 22nd April, of the creation of the Nuclear Safety Council, so that its breach will be penalised according to that decreed in chapter XIV (articles 85 to 93) of Law 25/1964, of the 29th April, on Nuclear Energy.

Eight. *Exemptions and equivalent measures.*

“Exemptions”: The NSC can temporarily exempt the owner from compliance with some of the requirements of this Instruction, as long as the owner justifies both the difficulty of satisfying said requirements in the established manner and that these prohibit said compliance, and the compensatory measures proposed for their exemption.

“Equivalent measures”: At the proposal of the owner, the NSC can favourably evaluate equivalent measures of compliance of the requirements stipulated in this Instruction, as long as the owner adequately accredits said compliance through the corresponding justification of the equivalent measures proposed.

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Single derogatory provision.

Any rule of equal or inferior status that opposes this instruction is overridden.

Final single provision.

This Instruction will come into force the day after its publication in the “Official State Gazette”.

Madrid, 15th November 2017 - Chairman of the Nuclear Safety Council, Fernando Marti Scharfhausen.

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